NONPROVISIONAL APPLICATION FOR LETTERS PATENT
UNITED STATES OF AMERICA

Be it known that I, **MONTE DAVIS**, residing at **5025 Hampton Bluff Court, Roswell, Georgia 30075**, a citizen of the United States, have invented certain new and useful improvements in a

VOCAL PITCH-TRAINING DEVICE

of which the following is a specification.

INVENTOR'S REPRESENTATIVE

BARRY E. KAPLAN, ESQ.
ASHISH D. PATEL, ESQ.

MYERS & KAPLAN
INTELLECTUAL PROPERTY LAW, L.L.C.
1899 Powers Ferry Road
Suite 310
Atlanta, GA 30339
Telephone: (770) 541-7444
Facsimile: (770) 541-7448
Email: bkaplan@mkiplaw.com

VOCAL PITCH-TRAINING DEVICE

CROSS-REFERENCE AND PRIORITY CLAIM TO RELATED APPLICATIONS

To the fullest extent permitted by law, the present nonprovisional patent application claims priority to and the full benefit of provisional patent application entitled "VOCAL PITCH-TRAINING DEVICE", filed on March 21, 2003, having assigned Serial No. 60/456,671.

TECHNICAL FIELD

The present invention relates generally to vocal training devices, and more specifically to a vocal pitch-training device. The present invention is particularly suitable for, although not strictly limited to, use by amateur or professional singers for training of the singer's mind to harmonize the function of the singer's vocal chords, mouth, throat, ears and diaphragm to reproduce and sustain a specified pitch.

BACKGROUND OF THE INVENTION

For many, vocal training plays a significant role in the development of career, personal confidence, education, and for some, in overcoming certain speech impediments.

For instance, for most orators and actors, development of proper vocal inflections could prove essential in effectively and credibly conveying a specific emotion, or the thrust of an argument. Additionally, some actors often undergo grueling language lessons to learn new languages or accents for a specific character role in a film or other performance. As such, many such professional orators and actors will spend an abundance of time in perfecting and reproducing desired inflections in their voice for effective conveyance of a speech or performance dialogue, respectively.

Further, some individuals are, unfortunately, inflicted with mental or physical disabilities that either impair normal cognitive vocal skills, or impart motor constraints thereon. Therefore, many such individuals undergo long, arduous, and often frustrating, vocal

rehabilitative sessions in attempts to assist in the development, training, or re-training of their vocal skills.

With respect to amateur and professional singers, the prospect of developing a successful and sustained singing career depends upon several factors, including, personal singing style, dedication to practice regimens, and most importantly, the singer's ability to physically and mentally train himself to perfect, duplicate and sustain desired key notes or pitches (i.e., training of the vocal cords and mind, respectively).

Accordingly, for purposes of developing the requisite physical and mental capabilities for reproduction of sustained note or pitch by singers, or for developing vocal skills, in general, for any of the above-described purposes, vocal trainees, during the training session, will often receive auditory and/or visual biofeedback, generally via headphones and/or a visual LED display, respectively, that compare the trainee's generated pitch or frequency, and compare it to the target pitch or frequency; thus,

enabling the singer or vocal trainee to adjust and match his/her vocal pitch or vocal inflections accordingly.

Examples of such dual-biofeedback vocal training systems may be seen with reference to U.S. Patent No. 5794,203 to Kehoe, and U.S. Patent No. 4,692,117 to Goodwin. Kehoe '203 discloses a biofeedback system for speech disorders, wherein the device incorporates both auditory and visual biofeedback mechanisms for assisting an individual reach a target pitch or note via the comparison of user-produced notes or pitches with target notes or pitches, and displaying the results of the comparison via auditory and visual biofeedback; thus, permitting the user of the device to more accurately change his/her voice pitch to match the auditory and visual signals and/or pitch of the target note.

Goodwin '117 discloses an acoustic energy real-time spectrum analyzer that also utilizes auditory and visual biofeedback technology in a substantially similar fashion to assist or train a singer to develop the singer's formant and/or effectively produce the proper or desired vocal pitch.

Although both the Kehoe '203 and Goodwin '117 devices utilize auditory and visual biofeedback technology for vocal-pitch training purposes, it has become increasingly apparent that improving one's singing skills, or one's vocal skills in general, via vocal training, requires much more than the employment of visual and auditory biofeedback alone. More specifically, although such dual-biofeedback vocal training systems are effective in assisting a trainee develop his/her specific requisite vocal goals, any recognizable vocal improvement is often achieved only after devoting or expending a significant amount of training or practicing time; that is, the results take far too long to achieve for the typical eager trainee looking for substantially immediate results, or at least some indication that headway has been made. As such, many trainees utilizing present vocal training systems often become frustrated and discontinue use of same in the absence of desired results within a desired period of time.

Therefore, it is readily apparent that there is a need for a vocal pitch-training device that provides expeditious results via auditory and visual biofeedback mechanisms in addition to tactile or physical biofeedback mechanisms for

a triple-biofeedback vocal pitch-training system that effectively harmonizes the function of the vocal trainee's vocal chords, mouth, throat, ears and diaphragm to permit the trainee to reproduce and sustain a specified pitch.

BRIEF SUMMARY OF THE INVENTION

Briefly described, in a preferred embodiment, the present invention overcomes the above-mentioned disadvantages and meets the recognized need for such a device by providing a vocal pitch-training device that provides for the holistic integration of instantaneous auditory, visual and physical biofeedback response that involve recognition of an auditory target pitch, the attempted production of a matching vocalized pitch, sensing any discordant biofeedback between the auditory target pitch and the user's vocalized pitch via the visual, auditory, and tactile biofeedback sources, and adjusting the user's vocalized pitch to match the target pitch by minimizing the discordant biofeedback as accomplished by raising or lowering the frequency of the user's pitch until a seemingly corresponding diminishment in sensation of physical biofeedback is achieved.

According to its major aspects and broadly stated, the present invention in its preferred form is a vocal pitch-training device having auditory, visual and physical biofeedback means.

More specifically, the present invention is a novel vocal pitch-training device that trains the user's mind to harmonize the function of the singer's vocal chords, mouth, throat, ears and diaphragm to reproduce and sustain a specified pitch at a selected note and/or key. Specifically, the device provides instantaneous auditory, visual and physical biofeedback that permits a user of the device to develop muscle and vocal memory to autonomously generate a specifically chosen "target note" or "target pitch" by teaching the user's mind to recognize complimentary and/or discordant auditory, visual, and physical vibrational signatures in the ears, throat, and body that inherently result from the user's conscious efforts to successfully match a vocally-generated "user-note" with a chosen "target note."

The device involves the user's sense of sight, sound and touch - a triple-sense-biofeedback loop. Through use

of the device, the user will learn to sing "on key" with proper pitch control by comparing the auditory, visual and physical biofeedback outputs from the device with the user's own vocal output delivered to the device as inputs, and thereafter, by user-modification of his/her own vocally-generated note or tone, to match his/her pitch with the auditory, visual and physical biofeedback outputs from the device as reference points. From such reference points, the user is able to instantaneously and intuitively adjust the frequency of his/her vocal output by elevating or lowering same until a desired harmony is achieved.

In one embodiment, the device is activated by a power-function key, wherein the user selects a "target note" (i.e., on a standard or programmable 12-note musical scale) and then depresses a corresponding note-function key. The device then displays the target note on an LCD screen; thus, providing the user with visual biofeedback. The device transmits the target note to the user via a tone generator worn in the user's ear (such as a headphone or ear jack); thus, providing the user with auditory biofeedback. The device also transmits a vibration equal in tone or pitch to the target note to the user via a tone-

generator or any other input vibrationally-responsive device worn against the user's throat, wrist, chest, head, or the like; thus, providing the user with tactile or physical biofeedback.

The user then attempts to generate a "user note" equal in pitch to the target note for input into the device via a microphone or similar device, whereby the device then analyzes the user-note and assigns a pitch or note value to the user note and displays it on the LCD screen; thus, further providing the user with visual biofeedback. The device continuously compares the pitch of the user-note to the pitch of the target note, and displays the correlation utilizing a progressive change in color of lights (i.e., visual feedback) that indicate to the user that the user's note or pitch is either flat, on-key or sharp, so that the user may adjust his/her voice output in an attempt to match the target note. Furthermore, if the user is off-key or off-pitch, pressure and/or discordant vibrations centered on the throat or vocal chord area are immediately felt by the user as a result of the discordant pitch or frequency between the user-note and the target note, thus providing additional physical bio-feedback.

When the pitch of the user note matches the pitch of the target note, the user will be visually notified by an LED light being displayed as green (or any other color). Additionally, and most importantly, the vibrations in the user's ear, throat and/or body produced by the physical or vibrational outputs of the device will also seemingly disappear, subside or become smooth in comparison to the vibrations of the vocal chords and ear drum of the user. Thus, complete auditory, visual and physical biofeedback is provided to the user.

It is contemplated that the present invention can be utilized to assist singer's reach of target notes, and/or could also be utilized to assist in physically rehabilitative speech efforts for the hearing impaired and/or those with injuries or physical impairments that have diminished their hearing and speech capacity, or by those seeking to adjust, modify, or improve their speaking voice in general.

Accordingly, a feature and advantage of the present invention is its incorporation of auditory, visual, and

physical biofeedback mechanisms to provide a triple-biofeedback vocal-pitch training system.

Another feature and advantage of the present invention is its ability to provide expeditious results and instantaneous response via the novel triple-biofeedback system.

Still another feature and advantage of the present invention is its ability to harmonize the function of the singer's vocal chords, mouth, throat, ears and diaphragm to reproduce and sustain a specified pitch.

Yet another feature and advantage of the present invention is its ability to be utilized by any individual seeking to improve or develop specific vocal skills, wherein such individuals may include, but are not limited to, orators, singers, actors, academic students, and/or those who suffer from mental or physical disabilities that adversely impact vocal skills.

A further feature and advantage of the present invention is its ability to provide multiple biofeedback

mechanisms that enable an individual lacking a key human sense (i.e., sight or touch) to utilize the device and all applicable and perceptible biofeedback mechanisms.

These and other features and advantages of the present invention will become more apparent to one skilled in the art from the following description and claims when read in light of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be better understood by reading the Detailed Description of the Preferred and Alternate Embodiments with reference to the accompanying drawing figures, in which like reference numerals denote similar structure and refer to like elements throughout, and in which:

FIG. 1 is a perspective view of a vocal pitch-training device according to a preferred embodiment of the present invention;

FIG. 2 is a perspective view of a headset of a vocal pitch-training device according to a preferred embodiment of the present invention; and,

FIG. 3 is a perspective view of an earpiece of a vocal pitch-training device according to an alternate embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED AND ALTERNATIVE EMBODIMENTS

In describing the preferred and alternate embodiments of the present invention, as illustrated in **FIGS. 1-3**, specific terminology is employed for the sake of clarity. The invention, however, is not intended to be limited to the specific terminology so selected, and it is to be understood that each specific element includes all technical equivalents that operate in a similar manner to accomplish similar functions.

With regard to established sound wave theories, when two or more sources of sound produce notes whose frequencies are not in harmony with one another, a

phenomenon known as "discordance" exists. The higher of the two frequencies cancels out the lower frequency and the resulting difference between them is transferred into the medium (i.e., air, water, or solids) in the form of a detectable vibration. When the human brain senses such vibrations within the body itself (including within the vocal chords or ear canal), it may interpret those insulting or offensive vibrations as "pain" or "discomfort." It is a natural and normal instinct for a person to then employ some sort of strategy and course of action designed to avoid and/or terminate such an insulting or offensive vibration. Thus, if the insulting or offensive vibration is determined to be the result of a conflict between incoming sounds (i.e., background noises, conversations of others, and/or music) and outgoing vocalizations, then the natural and unconscious inclination of the person will be to alter their own outgoing vocalizations (pitch) until "harmony" between the incoming and outgoing tones is reached and the vibrations caused by discordance cease. Thus, the speaker/singer will bend the frequency of their own vocalizations either upward or downward slightly until "harmony" is achieved and the insulting or offensive vibrations lessen or are eliminated.

As it relates to the task of speaking or singing specific target notes, there are two general categories of humans: 1) those with "perfect pitch" (i.e., the singer can accurately produce any note from memory alone); and, 2) those who do not have such innate skills (i.e., the vast majority of humanity).

The difference between those two groups is "reference points." Those with "perfect pitch" have internal references with which they can recall data, whereas most other singers need to hear at least one note produced through some type of sound generator (an instrument or another voice), wherein the note will then be utilized by the singer to guide him/her to vocalize in the proper key, and thus, enable the user to rely upon this/her training in proper musical (mathematical) intervals to stay on pitch while singing.

Accordingly, and as more fully described below, the present invention provides an electronic platform supporting separate levels of bio-feedback learning-loops (i.e., visual, auditory, and physical) which are designed to allow the user to experience, interact with, and learn

(memorize) the look, sound, and feel of each individually selected target notes. As a result of the above process, the present invention enables the user to store more information concerning each target note during a practice session than is currently being experienced and memorized by utilizing one's ears alone (i.e., essentially a single, auditory-feedback loop); thus, providing the student with greater storage, recall, and reproduction of practiced notes when the student is engaged in the ultimate act of speaking or singing.

Referring now to **FIGS. 1-2**, the present invention, in a preferred embodiment, is a vocal pitch-training device **10**, wherein device **10** preferably provides interactive main unit **15** and headset **100**, wherein interactive main unit **15** and headset **100** preferably cooperatively function to provide a user of device **10** with the requisite auditory, visual and physical biofeedback responses necessary to effectively assist the user in vocal pitch training, improvement and/or development, as more fully described below.

Interactive main unit **15** is preferably provided in the form of a foldable case comprising console **20** hingably connected to visual display portion **80** and communicatively coupled thereto via suitable data transfer means known within the art, such as, for exemplary purposes only, ribbon or other cable, infrared ports, or the like. Preferably, console **20** and visual display portion **80**, as well as headset **100**, include the requisite interactive circuitry and electronics for operation of device **10**, as known within the art. Additionally, console **20**, and device **10** in general, preferably provide computer means for comparison and analysis of user generated notes and target notes for generating the requisite input or output signals for implementation of the preferred method, as more fully described below. Preferably, the downward folding of visual display portion **80** toward console **20** permits the convenient, compact storage and/or transport of device **10**, wherein front side **22A** of console **20** preferably provides centrally disposed handle **24** to facilitate transport or carriage of device **10** to a desired location.

Preferably disposed proximate to handle **24** is infrared port **26**, wherein infrared port **26** preferably functions as a

wireless data transmission means for device **10**, transmitting and receiving desired information via infrared signals, as known within the art, and as more fully described below.

Preferably flanking infrared port **26** is first interface **28** and second interface **50**, utilized to permit user interaction with, and system operation of, console **20** and visual display portion **80**. Specifically, interface **28** preferably provides power key **30** for purposes of activating and deactivating device **10**; octave range selection keys **32** for purposes of selecting the appropriate octave scale or range for a user of device **10**; infrared power key **34** for purposes of activating and deactivating operation of infrared port **26**; sector power keys **36** for purposes of selectively activating or deactivating sectors of visual display portion, as more fully described below; microphone power key **38** for purposes of selectively activating or deactivating a microphone means, as more fully described below; speaker power key **42** for selectively activating an external four-way or two-way speaker system for purposes as more fully described below; and digital display **44** for purposes of indicating systems operation of device **10**,

selected octave range of device **10**, status of infrared transmission of infrared port **26**, current status of activated or deactivated sectors of visual display portion **80**, current status of the microphone means, and current status of speaker system. It is contemplated in an alternate embodiment that first interface **28** could possess any number and/or type of power-control or power-function keys for purposes of facilitating user-selected activation, deactivation, manipulation and/or adjustment of the various elements and components of device **10** as herein described.

Interface **50** preferably provides bi-directional socket **52** for the receipt and communicative coupling of headset **100** thereto, wherein bi-directional socket **52** preferably provides for the bi-directional transmission of audible and physical signals as generated by device **10** and by the user of device **10** during training sessions, as more fully described below. Interface **50** further preferably possesses volume control **54** for purposes of regulating the intensity of volume of the audible target signal generated by device **10** as conveyed through headset **100**, as more fully described below; physical vibrational control **56** for purposes of regulating the intensity of the physical vibration

generated by device **10** as conveyed through headset **100**, wherein the physical vibration is preferably a direct correlative function of the pitch of the audible target signal generated by device **10**, as more fully described below; and, auxiliary sockets **58** and **60** for purposes of outputting auditory and visual signals, respectively, for amplification by external auditory receiver sources and visual receiver sources, respectively, such as, for exemplary purposes only, surround-sound speaker systems and visual projectors, respectively. It is contemplated in an alternate embodiment that second interface **30** could possess any number and/or type of input or output sockets, and/or volume or signal intensity controls for purposes of facilitating user-selected manipulation and/or adjustment of the various auditory, visual and physical signals of device **10** as herein described.

Preferably, side **22B** of console **20** provides CD-ROM drive **62**, data disk drive **64**, and associated power buttons **68** on interface **66**, wherein CD-ROM drive **62** and data disk drive **64** preferably function to save, record, transmit, and/or install data and/or programs onto the computer circuitry of device **10**, or onto compact disks or other data

disks, as known within the art. CD-ROM drive **62** and data disk drive **64** are further preferably utilized to install specialized or upgraded vocal training programs or lessons onto device **10**, and further function to record the training session and/or performance of a user of device **10** for subsequent analysis, critique and improvement of same.

Preferably, top surface **22C** of console **20** provides keyboard **70** comprising bubble-type note keys **72**, wherein keyboard **70** and note keys **72** are preferably based upon a conventional or standard programmable 12-note musical scale, and wherein note keys **72** are preferably electrically coupled to the electrical circuitry of console **20**, and device **10** in general, as is known within the art. Preferably, indicator lights **74** corresponding to each individual note key **72**, and positioned on top surface **20C** of console **20**, proximal to note keys **72**, are activated upon depressing a specific note key **72**, wherein activation of an indicator light **74** preferably results in activation of a corresponding light on visual display portion **80**, delineating the selected note key **72**, for purpose as more fully described below. Preferably, indicator lights **74** are

in the form of light emitting diodes (LED), and preferably emit a green color when activated.

Preferably, back side **22D** of console **20** provides a plurality of input and output sockets **76** for interactive coupling of any desired visual and auditory displays, or additional physical or tactile biofeedback devices, as more fully described below.

Preferably, front side **80A** of visual display portion **80** comprises first graphical display interface **82** preferably positioned adjacent to target note reference display **84**, and second graphical display interface **86** positioned adjacent to user note reference display **88**, wherein target note reference display **84** and user note reference display **88** are preferably positioned adjacent one another, and thus, preferably separate first graphical display interface **82** and second graphical display interface **86** from one another, as best illustrated in **FIG. 1**. First graphical display interface **82** and second graphical display interface **86** are preferably liquid crystal displays (LCD); however, alternate forms of graphical displays could be utilized, such as, for exemplary purposes only, plasma

screens, projectors, television screens, projection screens, or the like. It should be further recognized that alternate, equally effective, configurations or arrangements of visual display portion **80** could be utilized without departing from the appreciative scope of the present invention, as such additions and/or modifications to configuration or arrangement are in full contemplation of the inventor in describing the present invention herein. Additionally, visual display portion **80** could possess any number and type of graphical display interfaces to facilitate use of device **10**.

As more fully detailed below, upon selection of a desired target note, and depressing the corresponding note key **72**, a visually displayed target note **82A**, as shown in Roman alphabet format, appears on first graphical display interface **82**, and is further preferably indicated on target note reference display **84** via a corresponding target note indicator light **84A**. A visually displayed frequency **82B** corresponding to the frequency of the user-selected target note is further displayed on first graphical display interface **82**, preferably in MHz/s. As indicated above, a corresponding indicator light **74** on console **20** is also

preferably illuminated upon depressing a selected note key **72**. Preferably, target note indicator lights **84A** of target note reference display **84** are in the form of color changing light emitting diodes (LED), for purposes more fully described below.

Similarly, and also as more fully detailed below, upon generation of a vocal pitch by a user of device **10** in attempts to match the selected target note, and upon detection, analysis, and comparison of same by device **10**, the user's generated note is translated into a visually displayed user note **86A** on second graphical display interface **86**, as shown in Roman alphabet format. The user's generated note is further preferably indicated on user note reference display **88** via a corresponding user note indicator light **88A**, wherein a visually displayed frequency **86B** corresponding to the frequency of the user's generated note is further displayed on second graphical display interface **86**, preferably in MHz/s. Preferably, user note indicator lights **88A** of user note reference display **88** are in the form of differently colored light emitting diodes (LED), for purposes more fully described below.

Preferably, sides **80B** and **80C** of visual display portion **80** possesses four-way external speaker systems **90** and **92**, respectively, wherein speaker systems **90** and **92** are preferably activated via speaker power key **42** on first interface **28**, as described above. Speaker systems **90** and **92** are preferably utilized when user of device **10** has garnered sufficient vocal skill so as to eliminate the need for the physical and auditory biofeedback supplied by headset **100**, wherein activation of speaker systems **90** and **92** permit generation of the target note therethrough, as well as the looping of user's generated vocal note back into the system for analysis, comparison, and subsequent audible display through speaker systems **90** and **92**, and visual display of the results (i.e., the user's note and frequency) on second graphical display interface **86** and user note reference display **88**. When speaker systems **90** and **92** are in use, user of device **10** preferably transmits his/her vocally generated pitch to device **10** via a conventional microphone, wherein the microphone is preferably interactively coupled to device **10** via microphone socket **94** positioned on top side **80D** of visual display portion **80**.

Preferably, rear side **80E** of visual display portion **80** possesses a compartmentalized storage housing **96** having hinged cover **98** thereover, wherein storage housing **96** is preferably adapted to receive and store spare LEDs, CD-ROMS, data disks, and headset **100** when in a folded state, as more fully described below.

Referring now to **FIG. 2**, headset **100** preferably comprises, head strap **102**, earpieces **104** and **106**, cable **108**, microphone **110** and physical biofeedback mechanism **112**, wherein headset **100** is preferably adjustably adapted to fit the head of any user, and wherein headset **100** is preferably collapsible or foldable via swivel or pivoting hinge **102A** positioned on head strap **102**.

Preferably, upon depressing a note key **72**, the corresponding target note is audibly generated and conveyed to earpieces **104** and **106** via cable **108** for audible reception by the wearer of headset **100**. Additionally, upon generation of a vocal pitch by a user of device **10** in attempts to match the selected audible target note being transmitted through earpieces **104** and **106**, the user's generated note is conveyed through microphone **110**, and

through cable **108** for detection, analysis, and comparison of same by device **10**, wherein the user's generated vocal pitch is thereafter re-conveyed or retransmitted back to headset **100** through earpieces **104** and **106** via cable **108** for auditory biofeedback purposes, as more fully developed below. Preferably microphone **110** possesses flexibly adjustable arm **110A** and microphone head **110B**, wherein arm **110A** of microphone **110** is preferably attached to and extends from earpiece **104**.

Preferably, upon depressing a note key **72**, the corresponding target note is also translated into a physical vibration by device **10** and conveyed to physical biofeedback mechanism **112** via cable **108** for tactile or physical sensing or reception by the wearer of headset **100**, wherein vibrational pad **112A** is preferably placed against the wearer's throat, over the vocal cord region, for physical biofeedback purposes, as more fully described below. Preferably physical biofeedback mechanism **112** provides telescoping arm **112B** having a pivoting mechanism **112C** engaged therewith; thus, permitting user-adjustability of physical biofeedback mechanism **112** for purposes of more effectively positioning vibrational pad **112A** against the

user's throat. Telescoping arm **112B** is preferably attached to and extends from earpiece **106**; however, it is contemplated in an alternate embodiment that physical biofeedback mechanism **112** and microphone **110**, in general, could be affixed to earpieces **104** and **106**, respectively, or could alternatively, be removably interchangeable therebetween to accommodate the user thereof. Additionally, although headset **100** is preferred as a matter of convenience for compact functionality, it is contemplated in another alternate embodiment, that physical biofeedback mechanism **112** and microphone **110** could be integrated into the system in any other suitable fashion, such as, for exemplary purposes, separate cables and/or devices. It should be recognized that the term "physical" of physical biofeedback mechanism **112** is synonymous with the term "tactile," wherein both terms are intended to semantically convey the idea that biofeedback mechanism **112** interacts with the user via the sense of touch and via vibrational sensory means.

Although physical biofeedback mechanism **112** is preferably in the form of a vibrational pad **112A** placed against the throat of a wearer of headset **100**, it is

contemplated in an alternate embodiment that physical biofeedback mechanism **112** could be any other suitable mechanism capable of being worn or placed in contact with a user of device **10**, and capable of delivering the requisite physical vibrations thereto, wherein such a mechanism could be in the form of, but not limited to, a helmet, shoe, wristband, belt, vest, nosepiece, earpiece, body suit, eyewear, skullcap, hat, headgear, forearm unit, gel floor mat, and/or combinations thereof. It is contemplated in an additional alternate embodiment that headset **100** could incorporate an earpiece that transmits both auditory and physical signals to the wearer. It is contemplated in yet another alternate embodiment that physical biofeedback mechanism **112**, and/or headset **100** in general, could be wireless, operating via infrared signals with infrared port **26**, or through other suitable wireless technologies.

Cable **108** of headset **100** is preferably interactively coupled to device **10** via inserting cable jack **108A** of cable **108** into bi-directional socket **52** of interface **50** of console **20**, wherein bi-directional socket **52** preferably provides for the bi-directional transmission of audible and physical signals as generated by device **10** and by the user

of device **10** (i.e., wearer of headset **100**) during training sessions, or the like. As indicated above, the intensity of volume of the audible target note signal generated by device **10** and conveyed through headset **100** is preferably controlled or regulated via volume control **54** of interface **50**. Furthermore, the intensity of the physical vibration generated by device **10** and conveyed through vibrational pad **112** of headset **100** is preferably controlled or regulated via physical vibrational control **56** of interface **50**, wherein the physical vibration is preferably a direct correlative function of the pitch of the audible target note signal generated by device **10**.

In use, device **10** is preferably activated by depressing power key **30**, wherein the user then preferably selects a "target note" (i.e., a target pitch or note that the user of device **10** wishes to vocally reproduce and practice) and depresses the corresponding note key **72** on keyboard **70**. Preferably, upon depressing a specific note key **72**, indicator light **74** on keyboard **70** illuminates; thus, resulting in illumination of corresponding target note indicator light **84A** on target note reference display **84**. Preferably simultaneously, visually displayed target

note **82A** appears on first graphical display interface **82**, along with frequency **82B** of the target note. Preferably, the target note indicator light **84A** representing the selected target note is blue in color upon initial illumination and depression of the selected note key **72**, as is the corresponding visually displayed target note **82A**, wherein user generation of a vocal pitch in accord or harmony with the pitch of the selected target note preferably results in target note indicator light **84A** and visually displayed target note **82A** illuminating the color green, as more fully described below. As indicated above, the plurality of visual lights and displays as illustrated herein, and specifically with reference to visual display portion **80**, preferably provide the user of device **10** with continuous visual biofeedback.

Furthermore, upon depression of selected note key **72**, device **10** audibly transmits the target note or pitch to the user via earpieces **104** and **106** of headset **100**; thus, supplying the user with auditory biofeedback. Device **10** further transmits a vibration equal in tone or pitch to the target note to the user via vibrational pad **112A** of physical biofeedback mechanism **112**; thus, providing the

user with physical biofeedback, wherein vibrations equal to the pitch/frequency of the target note resonate against the user's throat area, and provide physical biofeedback to the user.

The user then attempts to vocally generate a "user note" or pitch equal in pitch to the target note, wherein the user's vocally generated user note is preferably conveyed to device **10** via microphone **110** of headset **100**, whereby vibrations equal to the pitch or frequency of the vocally-generated user note are also preferably immediately felt by the user in the user's throat or vocal chord area via vibrational pad **112A**, thus providing the user with physical biofeedback.

Device **10** then analyzes the user note, assigning a pitch or note value to the user note and displaying it on second graphical display interface **86** as visually displayed user note **86A**; thus, providing the user with further visual biofeedback. The note or pitch of the user note is further preferably indicated on user note reference display **88** via a corresponding user note indicator light **88A**, wherein a visually displayed frequency **86B** corresponding to the

frequency of the user's generated note is further displayed on second graphical display interface **86**. Each indicator light **88A** preferably corresponds to an individual musical note within a musical scale. Device **10** continuously compares the pitch of the user note to the pitch of the target note, and preferably displays the correlation or comparison via a progressive change in color of indicator lights **88A** on user note reference display **88**.

Specifically, upon initial generation of the user note, and analysis of same by device **10**, the indicator light **88A** corresponding to the pitch of the user note remains red in color for so long as the pitch of the user note differs from the pitch of the target note. As the user fluctuates or changes his/her vocal pitch in attempts to match the pitch of the target note audibly and physically sensed by the user via headset **100**, and, thus, vocally moves up or down the musical scale as represented by indicator lights **88A**, the indicator light **88A** corresponding to each change in pitch or note begins to illuminate. When the user is able to generate a vocal pitch that corresponds to the indicator light **88A** positioned three intervals or pitches away from the

indicator light **88A** that represents the pitch of the target note, the former indicator light **88A** changes to yellow. When user is able to generate a vocal pitch that corresponds to the pitch of the target note, the indicator light **88A** that represents the pitch of the target note becomes illuminated, preferably emitting a green light to indicate a perfect pitch match. The color of visually displayed user note **86A** will also change or fluctuate in accord with changes in pitch of the user's generated note, remaining a single color only when the user's pitch is constant. Such a progressive change in color of indicator lights **88A** and visually displayed user note **86A** preferably visually notifies the user that the his/her note or pitch is either flat, on-key or sharp, so that the user may adjust his/her voice output in an attempt to match the target note; thus, providing the user with additional visual biofeedback.

Furthermore, if the user is off-key or off-pitch, the user will feel, via physical biofeedback form vibrational pad **112A**, the pressure and/or discordant vibrations centered on the user's throat or voice box. The user's mind and body analyzes the user note in comparison with the

auditory, visual and physical biofeedback from device **10** to the user, wherein if the user note is either "off-pitch" or "off-key", the user will be immediately receptive of the discordant vocal performance due to the feeling of pressure and/or discordant vibrations centered on the user's throat and vocal chords. As such, when the pitch or frequency of the vocally-generated user note does not precisely match the pitch or frequency of the selected target note or any harmoniously correct alternative note in relation to the target note, the user must then attempt to correct his/her vocal output so as to be either "on-pitch" (i.e., the target note and user note are identical) or "on-key" (i.e., the user note represents a harmoniously correct alternative note in relation to the target note); thereby, reducing or negating the physical vibrations from vibrational pad **112A** felt against the user's throat.

More specifically, when the pitch or frequency of the user note matches the pitch or frequency of the selected target note, the user will be visually notified by visually displayed target note **82A**, target note indicator light **84A**, visually displayed user note **86A**, and user note indicator light **88A** being displayed as green; and physically notified

by the seeming dissipation of vibrations against the user's throat, wherein production of a user note that is either on-key or on-pitch with the target note will cause the sensation of physical vibrational outputs of vibrational pad **112A** to seemingly disappear, subside or become smooth in comparison to the vibrations from the vocal chords (and ear canal of the user if serving as an auditory and physical biofeedback mechanism, as described above). In this manner, device **10** provides the user with the complete or final auditory, visual and physical biofeedback to train the user to sustain and reproduce target notes.

Device **10** will continue to display, generate and transmit the target note until the same note key **72** is depressed again or a different note key **72** selected. Device **10** will further continuously analyze and display the user note until the user ceases to speak or sing.

Preferably, it is contemplated that use of device **10** for vocal training purposes serves to strengthen the muscles of the throat, tongue, palette, jaw, and vocal chords for improved muscular flexibility and/or manipulation of same; thereby, reducing injury due to

otherwise over-constrained or untrained muscles. Additionally, use of device **10** preferably functions to further strengthen the muscles of the diaphragm and chest wall; thus, allowing deeper lung inhalation and exhalation, and greater breath volume which translates to a stronger, steadier, more comfortable and accurate tonal projection of the user's voice.

Furthermore, preferably via visual notification by visually displayed user note **86A** and user note indicator light **88A**, and physical vibration via physical biofeedback mechanism 112, a user of device **10** is able to establish an immediate reference point upon initial vocal output, thus guiding the user to effectively achieve or reach the target note.

It is contemplated that device **10** could be utilized to assist in physically rehabilitative speech therapy for those suffering from either congenital speech impediments, partial or total deafness, or injury resulting from stroke or physical trauma to the throat, or related bodily areas that directly or indirectly influence vocal projection, enunciation and speech.

Referring now more specifically to **FIG. 3**, illustrated therein is an earpiece **200** for application in a method of vocal pitch-training according to an alternate embodiment of the present invention. Specifically, earpiece **200** is shaped and configured to be comfortably received within the user's ear **E**, and comprises inner chamber **202** bifurcated via vibratory membrane **204**, thereby dividing inner chamber **202** into user-pitch chamber **206** and reference pitch chamber **208**. Formed through earpiece **200**, and in communication with reference pitch chamber **208**, is aperture **210**, through which an ambient audible reference note/pitch is permitted to enter, deflect against vibratory membrane **204**, and exit back through aperture **210**, thereby resulting in vibration of vibratory membrane **204**, and providing the user with physical biofeedback due to the vibrations felt within the user's ear canal, as more fully described below.

Extending from earpiece **200**, and in communication with user-pitch chamber **206**, is frusto-conical-shaped protrusion **212** comprising aperture **212a** formed therethrough and residing in communication with user-pitch chamber **206**.

Additionally, formed through earpiece **200**, and also in communication with user-pitch chamber **206**, is aperture **214**. Earpiece **200** is worn in a user's ear **E** such that protrusion **212** is received within the user's ear canal, and such that aperture **214** is exposed and positioned closest to the user's mouth, proximal the user's lower earlobe **LE**. In such an orientation, aperture **210** is exposed and resides proximate to the user's upper earlobe **UE**. To assist in maintaining earpiece **200** within a user's ear **E**, fin **216** extends from earpiece **200**, and is suitably dimensioned to be received within the folds of upper earlobe **UE**. Accordingly, and pursuant to well-established principles of sound wave travel, it should be recognized that vocalized user pitches or notes leave the user's mouth and travel in multiple directions - most notably, around the user's head. As such, upon generation of a user note/pitch, and subsequent travel of same around the user's head and toward the user's ear **E**, sound waves enter aperture **214**, travel through user-pitch chamber **206**, and strike vibratory membrane **204**, thus resulting in additional vibration of same and providing the user with physical biofeedback due to corresponding vibrations felt within the user's ear canal. As the user senses the vibrationally discordant

biofeedback between his/her vocalized pitch and the ambient reference pitch as a result of the discordantly vibrating vibratory membrane **204**, the user adjusts his/her vocalized pitch in an attempt to minimize the discordant biofeedback as recognized by a seemingly corresponding diminishment of physical biofeedback (i.e., diminishment or elimination of sensation of vibration within the user's ear canal).

It should be recognized that earpiece **200** could further comprise the requisite nanotechnology adapted to wirelessly interact with interactive main unit **15**.

It is contemplated in an alternate embodiment that device **10** may be configured in any arrangement conducive to transmitting auditory, physical and visual biofeedback to the user thereof.

It is contemplated in another alternate embodiment that a user of device **10** could utilize the auditory, physical and visual biofeedback mechanisms of the present invention either individually or in a selected combination thereof; thereby, effectuating a user-designed pitch training process.

It is contemplated in still another alternate embodiment that the vibrational intensity of physical biofeedback mechanism **112** could be automatically regulated by device **10**, wherein the vibrational sensation felt by the user would correspondingly increase or decrease as the frequency of the user's pitch moved farther from or closer to the target pitch.

It is contemplated in yet another alternate embodiment that wall mountable flat screen visual displays or panels could also be utilized to effectuate visual biofeedback.

It is contemplated in still yet another alternate embodiment that software programs may be utilized in conjunction with device **10** to permit sheet music to stream across graphical interface displays **82** and **86**.

It is contemplated in a further alternate embodiment that a karaoke machine, either adjunctively associated or integrally formed with device **10**, may be utilized in combination therewith to permit "target" sheet music, audible music, and/or lyrics to stream across graphical

interface display **82**, wherein a user of the present alternate device would then attempt to vocally match the "target" sheet music, audible music, and/or lyrics for analysis and comparison by device **10** via an equivalent method as described herein, and wherein the results of the user's analyzed and compared vocally generated response would then be visual displayed on graphical interface display **86**, physically sensed via physical biofeedback means **112** and audible sensed via headset **100**, or via any other suitable alternate embodiment described herein or otherwise.

It is contemplated in still a further alternate embodiment that device **10** could be coupled to the Internet, or other global networking systems, for downloading training programs, effectuating live interactive online training sessions, and/or updating system operations of device **10**.

It is contemplated in yet a further alternate embodiment that device **10** could entirely be in the form of a helmet.

It is contemplated in another and further alternate embodiment that device **10** could entirely be in the form of a handheld or wearable unit, ideally in the form of a handheld microphone capable of conveying and receiving audible biofeedback signals, visual biofeedback signals via a visual display mounted thereon or in association therewith, and physical biofeedback signals via the hand grip on the microphone, wherein all such biofeedback signals would be conveyed and received via bi-directional cabling and/or other suitable transmission mediums.

Having thus described exemplary embodiments of the present invention, it should be noted by those skilled in the art that the within disclosures are exemplary only, and that various other alternatives, adaptations, and modifications may be made within the scope of the present invention. Accordingly, the present invention is not limited to the specific embodiments illustrated herein, but is limited only by the following claims.